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ABSTRACT

The purpose of this booklet is to provide an introduction to the many complex issues of waste management in the United States. It is designed to raise public awareness of the serious impact of current waste generation and disposal practices and to promote alternatives. It encourages citizens to involve themselves in decisions about the way waste is managed in their communities and promotes the adoption of integrated systems designed specifically for their local needs. Discussed are: (1) the definition of waste; (2) human health and environmental effects; (3) costs to communities; (4) waste management; (5) legislation; (6) exemplary programs; and (7) action guidelines. Listings include over 100 information sources, 25 selected readings, and 35 references. (CW)

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About This Booklet

The purpose of this booklet is to provide an introduction to the many complex issues of waste management in the US. It is designed to raise public awareness of the serious impact of current waste generation and disposal practices and to promote alternatives. As a part of CONCERN's Waste Minimization Program, it encourages citizens to involve themselves in decisions about the way waste is managed in their communities and promotes the adoption of integrated systems designed specifically for their local needs.

This is the sixth in CONCERN's community action guide series which includes *Hazardous Waste* (out of print), *Groundwater, Pesticides, Drinking Water,* and *Farmland.* Special bulk rates are available for non-profit organizations. Single copies are three dollars.

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Waste

Choices for Communities

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The Issue

Garbage, rubbish, trash, junk, refuse, waste—all are names for what we as individuals, communities, or businesses throw away, from toxic chemicals to automobiles to grass clippings and leaves. The volume of waste is increasing as we turn more and more to over-packaged and disposable products. The types of waste are changing as chemically-based products multiply. Many of them are toxic or non-biodegradable or both. The amount of refuse discarded by American households is staggering: estimates are as high as a ton a year per person.

Waste disposal is an immediate, critical problem for communities all over the US. Citizens are discovering that there is no easy way to get rid of the garbage they once assumed could be buried or burned and forgotten. Waste disposal costs are escalating and demanding an increasing percentage of community budgets. Current disposal methods threaten our health and environment. Most industrial, commercial, and household wastes are now being placed in landfills or surface impoundments or burned in incinerators. They may contaminate groundwater, rivers, and streams. When burned, they release hazardous gases into the air and leave toxic residues in the form of ash. They pollute the oceans and litter the beaches.

The landfills that once provided a deceptively simple solution are closing either because they are full or because they do not meet new federal or state standards. One third of the landfills in the country will be full within five years. Siting of new landfills is difficult because of public opposition. As landfills close and costs of landfilling escalate, the pressure to incinerate mounts. Incinerators, costly to build and operate, are often inefficient and can contribute to serious environmental degradation and threaten public health. Those who resist incineration do so because of legitimate concerns about air pollution and land use, but many also realize that burning waste squanders potentially valuable resources.

People in communities all over the country are beginning to realize that the solution lies in using garbage as a resource rather than as refuse to be destroyed. Increasingly, localities now choose to recycle rather than to burn thereby greatly decreasing detrimental effects on the environment.

A change in the way we think about waste will also require that we find ways to generate less—and less hazardous—waste in the first place. In industry this means altering manufacturing processes or substituting non-toxic materials for hazardous ones. When dealing with household and commercial waste, "source reduction," as this concept is called, means the elimination of unnecessary packaging, the substitution of biodegradable materials for non-biodegradable ones, and the use of non-toxic products.

Many communities that handle waste successfully have developed an "integrated waste management" system which treats garbage as a resource for the economic and environmental improvement of the community. Articulated in the 1970s, this system is completely local in its analysis of needs and in its decisions about management. Source reduction and recycling are the technologies of choice; incineration and landfilling are used only when necessary.

States can provide technical and financial assistance, promote regional planning, and provide information on markets even though the options chosen for waste management will depend ultimately on local conditions and needs. The federal government should give solid waste management the priority it requires through funding and technological guidance and by setting national goals for recycling and standards for packaging. A key factor is the educated involvement of each citizen, whether by participation in decision-making or by the improvement of consumer purchasing and disposal practices. This booklet will focus on non-hazardous waste and specifically on the waste generated by communities—municipal solid waste.

Types of Waste

The ways in which the various types of waste are categorized and defined by government regulations can be confusing. General categories to become familiar with are solid waste, both municipal and industrial, and wastewater. "Solid" waste actually includes semi-solid and liquid materials as well as gaseous wastes in containers. For the purpose of regulation, waste is also classified as either hazardous or non-hazardous with different regulations for disposal. Current government regulations, however, permit some hazardous wastes to be discarded with the non-hazardous, thus generating serious environmental problems. For example, municipal solid waste contains hazardous household and commercial toxic products both of which can pose a significant threat to groundwater. Under present regulations even wastes that are designated as non-hazardous can pollute air, soil, and water.

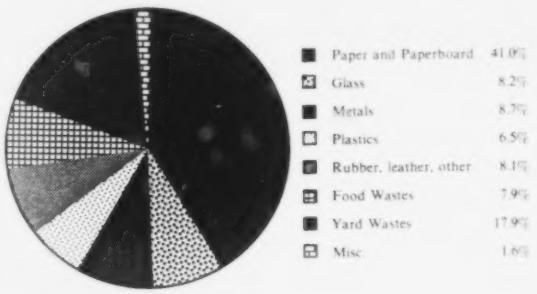
The refuse discarded by households, institutions, and commercial establishments is referred to as **municipal solid waste.** Each US citizen produces some four to six pounds per day. This amounts to 179 to 268 million tons per year of municipal waste. Currently, 80% of this goes to landfills, 10% is incinerated, and about 10% is recycled. An undetermined amount of waste is dumped illegally on land and at sea.

Industrial solid waste generally consists of such

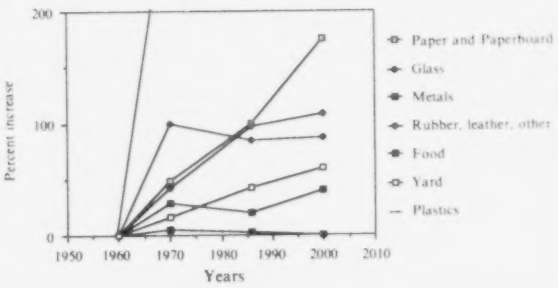
The Nation's Discards

What They Are

Composition of Municipal Waste

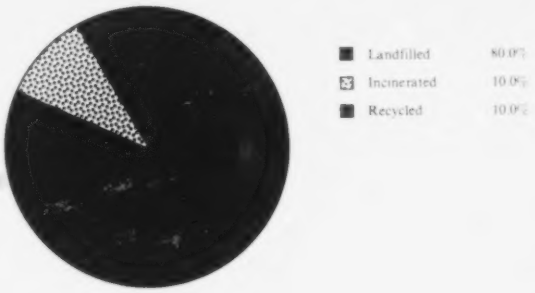


Increases in Waste

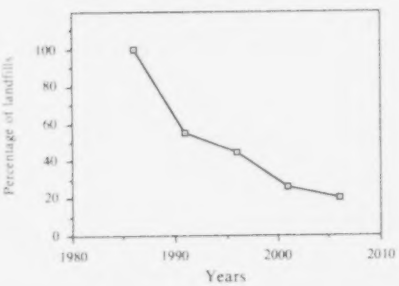


Where They Go

How Wastes Were Disposed of in 1987-88



Remaining Life of Municipal Solid Waste Landfills



Sources: U.S. Environmental Protection Agency. *The Solid Waste Dilemma: An Agenda for Action.* Draft Report of the Municipal Solid Waste Task Force. EPA Office of Solid Waste, September 1988. *Results of a Municipal Solid Waste Landfill Study*, USEPA, Unpublished—Office of Solid Waste, 1987.

materials as wastewater treatment sludges (wastes with most of the water removed), plastics, oil paint, metal, and coal ash. Despite their categorization as non-hazardous, these wastes often contain heavy metals and other polluting substances such as oils, plastic resins, and solvents.

Information on the generation of industrial non-hazardous waste is sketchy and dated. A 1985 Environmental Protection Agency (EPA) study estimated the volume of this kind of waste at approximately 432 million tons per year. Some of the information used, however, was ten years old. According to the report, twelve industries were responsible for 99% of all industrial non-hazardous wastes, and the chemical industry alone for 25%.

About 60% of this waste is managed on-site in landfills, in surface impoundments, or spread on the land in "land application units" and waste piles. The remainder goes to land facilities off-site or is discharged to wastewater treatment plants and/or surface waters.[1] An undetermined quantity of construction and demolition debris is generated annually. It is generally placed in landfills.

The effluent from industrial, mining, oil and gas operations, municipalities, small businesses, and households is called **wastewater.** When discharged from a pipe to surface water, it is regulated as a "point" source under the Clean Water Act (CWA). Most water from a diffuse or "non-point" source, such as agricultural runoff and domestic septic systems, is not regulated at all.

The Clean Water Act limits the amount and type of toxics that facilities may release to surface waters. Liquid wastes from industrial and other operations which may not be legally discharged directly into rivers and streams are stored or treated in surface impoundments, most of which are unlined. There are roughly 190,000 surface impoundments in the US holding such liquid and semi-liquid wastes as sewage sludge, industrial and agricultural wastes, and others. Some allow liquids to seep into soil or to evaporate. Most are designed to discharge wastewater into surface water after solids have settled.

Sewage sludge is landfilled, incinerated, spread on land, or composted. New York City and eight other New York and New Jersey sewage authorities are still dumping sewage at sea, but Congress is moving to prohibit this after 1992.

Hazardous waste, regulated by the Resource Conservation and Recovery Act (RCRA) and its amendments, is defined as any waste that is "corrosive, ignitible, reactive, or toxic," or that poses a substantial threat to human health and the environment when improperly managed. Only 400 specific wastes are officially listed as hazardous. However, there are many more hazardous or potentially hazardous wastes that are not covered by the RCRA definition. Some, such as industrial wastewater discharged directly into surface waters, are covered under the Clean Water Act (CWA). Others, such as sewage from septic tanks and irrigation return flows, are not covered by any legislation.

According to the US Environmental Protection Agency, some 40,000-60,000 operations that generate large quantities of hazardous waste and approximately 100,000 small generators produced about 303 million tons of hazardous waste in 1985. Many feel this estimate is low. A 1987 Government Accounting Office report concluded that "we cannot estimate the amount, location, and source of hazardous waste being produced, either nationally or at the state level, with confidence."

Over 70% of hazardous wastes are generated by the chemical industry. Other major generators include the petroleum and metals industries and federal agencies, mainly the Departments of Defense and Energy. To a much lesser extent, small businesses and households also contribute to the problem: "small quantity generators"—those that generate between 220 and 2200 pounds of hazardous waste per month—include dry cleaners, car maintenance firms, laboratories, and equipment repair shops. Prior to 1984 these small generators were not regulated and until 1986 could dump up to a ton a month of hazardous waste into municipal landfills. Generators of less than 220 pounds per month are not regulated. Household hazardous waste, which includes cleansers, paints, and pesticides, is also still unregulated. Some communities have arranged collection days for these wastes, but most people are left without options for disposal, and most of it still goes to municipal landfills.

The bulk of hazardous wastes are managed on-site by private companies where they are treated in special wastewater systems or placed in pits, ponds, and lagoons called surface impoundments. A fraction are recycled or disposed of on land. Those wastes not handled on-site are sent to commercial facilities. Ten percent of hazardous wastes are injected into underground wells—deep injection wells—where they pose a serious threat to groundwater.

Sources: U.S. Environmental Protection Agency. *The Hazardous Waste System.* Washington, DC: EPA, June 1987 and U. S. Government Accounting Office. *Hazardous Waste: Uncertainties of Existing Data.* Washington, DC: GAO, February 1987.

Waste Disposal

The Landfill Squeeze

Dumping trash in landfills is becoming a less and less viable solution. Half of the cities in the US will be without them by 1990 because the landfills are either full or unable to comply with new, more stringent regulations. The Fresh Kills landfill on Staten Island, for example, where New York City dumps much of its 27,000 tons per day of refuse, has only about five years of capacity left.

Many localities are finding that the costs of providing new landfill capacity and of cleaning up existing landfills that are polluting groundwater are too high to be borne locally. Hundreds of towns in Maine, for example, are shifting to regional facilities.

Faced with diminishing landfill space, some communities send their wastes to other states, a practice sanctioned by the Supreme Court ruling in 1978 (Philadelphia v. New Jersey) that a state may not refuse waste from another state. Communities that have tried to extend landfill capacity by recycling or reducing their own wastes sometimes find that the saved space is filled by waste from other counties or states. Despite the Supreme Court decision, states are attempting to limit waste coming in from other states; some are considering levying surcharges on out-of-state trash or limiting the development of new landfill capacities.

Ohio, faced with a 40% decline in landfill space since 1960 and a growing amount of waste generated both in and out of state, passed legislation in 1988 requiring communities to form solid waste districts which must draw up comprehensive 10-year plans, including the establishment of limits on future landfill capacity.

Some communities have even tried to ship waste to other countries. The famous garbage barge from Islip, New York, captured nationwide attention when it traveled widely, unable to dump its load of 3,120 tons of refuse for six months. The trash was eventually burned in a Brooklyn incinerator and the ash buried in Islip's landfill.

Incineration Technologies

Although only 10% of municipal refuse is now burned, the use of incineration is increasing as landfill space becomes scarce. Over one hundred plants are currently operating; 210 additional plants are planned or under construction.[2] No longer the relatively simple facilities of the past, today's incinerators have greater capacities and more advanced technology. Some recycle part of the refuse by recovering either materials or energy from it. If they generate energy, they are called waste-to-energy or resource recovery plants,

Photo Bill Snead *The Washington Post*

Hackensack Meadowlands, New Jersey's largest landfill.

and the steam or the electricity produced is sold.

Some of these facilities pre-sort the refuse before incineration. Reusable materials, including ferrous metals, are recovered and sold. Some resource recovery plants also compost the organic components of the waste stream. Such separation not only permits recycling but can affect the toxicity of emissions and ash. Removal of such materials as chlorinated plastics can significantly reduce dangerous emissions.

Mass burn incinerators dump unsorted trash into furnaces and burn it either in large, very hot refractory furnaces to reduce it, or in waterwall furnaces to generate steam and/or electricity. Mass burn plants typically handle 500-3000 tons per day of refuse, though their capacities are growing dramatically. Altogether they account for two-thirds of the available incinerator capacity. Another form of this plant, called modular mass burn, is a smaller version, handling 40-100 tons per day of refuse. Modular units are used as municipal incinerators and can also be located on industrial sites to reduce a facility's wastes; the energy generated is used by the company itself.

Refuse-derived fuel (RDF) plants make burnable materials from mixed solid waste and burn them to produce energy. The most stable are pellets which, like all refuse, are less efficient than fossil fuel; a pound of RDF produces about half as much energy as coal and about a third as much as oil.[3] This kind of plant, however, is more efficient than a mass burn or modular facility because recyclable materials like metals and glass have been removed. Tests show that certain RDF processes produce considerably fewer dangerous emissions than mass burn plants.[4]

The Burning Question

Proponents of incineration plants say that because of the scarcity of landfills and the tremendous proliferation of waste the most efficient method of reducing its volume is by burning and in the process recovering energy, thus reducing our dependence on fossil fuels.

Critics charge that the air emissions and ash that incinerators generate are toxic, largely unregulated, and a threat to public health and the environment; that incinerators burn materials that could otherwise be recycled; that they have poor operating records and inadequate emissions control technology; that new plants are costly; that they often depend on trash from other communities; that in order to run efficiently they require a "flow control" ordinance, or a guaranteed waste flow, discouraging any attempts at recycling or source reduction; that the same volume reduction achieved by incineration could be accomplished by recycling; and that the energy they recover is only a fraction of the energy that is saved by even a minor commitment to recycling.

Emissions from incinerator stacks have been known to include up to 27 heavy metals, acid gases, carbon monoxide, and dioxins. As of mid-1988 they were not regulated by the federal government.

Incinerator ash may also contain the same kinds of pollutants that leach from landfills or that are contained in emissions. EPA has ruled that ash must be tested and, if found to be hazardous, must be treated as hazardous waste. In actuality ash is rarely tested and is usually disposed of in municipal landfills or ash monofills. In 1987 the Environmental Defense Fund conducted tests on ash from waste-to-energy facilities using the "EP (Extraction Procedure) Toxicity Test" which indicates the degree to which metals contained in ash would leach into groundwater. All of the fly ash (the lightweight particles trapped by the emissions control equipment) and over a third of the bottom ash (the heavier slag left in the bottom of the incinerator, or about 90% of the total ash) tested failed the toxicity tests because of contamination by heavy metals. About half the combined ash failed. Other tests of mass burn ash in the US and foreign countries show unacceptable levels of lead, cadmium, or both, in fly ash and sometimes in the bottom ash.[5] When ash is dumped with solid waste into municipal landfills, its toxic effects, rather than being diluted, actually can be exacerbated because the combination of chemicals in a landfill hastens the leaching of metals.

An incinerator can become an economic burden to a community. Westchester County, New York, bought a $180 million incinerator in the early 1980s, agreeing to pay a temporarily inflated price for the electricity generated. Since it opened in 1984, the incinerator has had mechanical problems forcing shutdowns, and the electricity has cost the county $30 million more than if it had been bought from the utility.[6] Several of the communities expected to provide fees to the operation have pulled out and are shipping their garbage out of state.

If communities do choose incineration, it should be integrated with other disposal options of recycling, reuse, composting, and landfilling. A system should be in place to remove all recyclables and heavy metals in a separate materials recovery system before combustion. The best available technology—for example, scrubbers and baghouses to trap air pollutants—

should be used and updated. Emissions must be monitored regularly and tested for heavy metals and dioxins. Environmentally-safe storage, transportation, and disposal of fly and bottom ash is critical. The size of the incinerator should be appropriate for the community involved and not dependent on waste from neighboring areas to operate efficiently. A decision about its size should also take into account the present and future recycling potential of the community.

Municipal Waste Combustion Facilities in the US (1986)

State	Existing	Planned
Alabama	1	1
Alaska	1	1
Arizona	0	0
Arkansas	7	1
California	0	36
Colorado	0	0
Connecticut	4	11
Delaware	0	1
Florida	6	13
Georgia	0	1
Hawaii	1	1
Idaho	1	0
Illinois	1	2
Indiana	1	2
Iowa	1	0
Kansas	0	0
Kentucky	2	2
Louisiana	1	0
Maine	2	5
Maryland	2	4
Massachusetts	6	11
Michigan	2	5
Minnesota	5	7
Mississippi	1	0
Missouri	2	1
Montana	1	0
Nebraska	0	0
Nevada	0	1
New Hampshire	12	6
New Jersey	0	20
New Mexico	0	0
New York	12	23
North Carolina	2	2
North Dakota	0	1
Ohio	5	2
Oklahoma	2	0
Oregon	1	1
Pennsylvania	3	26
Rhode Island	0	3
South Carolina	2	1
South Dakota	0	0
Tennessee	5	1
Texas	6	6
Utah	1	0
Vermont	0	2
Virginia	7	4
Washington	2	5
West Virginia	0	0
Wisconsin	4	0
Wyoming	0	0
District of Columbia	1	0

Source: Radian Corporation. EPA *Municipal Combustion Study: Characterization of the Municipal Waste Combustion Industry*, June 1987.

How to Judge an Incineration Proposal

Evaluate your community's waste stream and waste disposal plans. If you have a large proportion of food and yard waste, for instance, and an average community can have about 30%, compost rather than burn it.

Determine what percentage can be recycled before landfilling or incineration. Be aware that incineration limits recycling through its demands for a guaranteed flow of waste.

Investigate materials recovery systems which use no incineration at all.

Calculate how much waste the incinerator will burn; how much ash and unburned waste will remain to be landfilled.

Determine how much the incinerator will cost the community. Who will insure the project and how much risk is the public accepting? Who will buy the energy produced, if any, and who will determine the cost per kilowatt? Does your community reimburse the corporation if it does not produce enough energy to make a profit? Who will pay for landfilling when the plant is being repaired?

Match the size of the operation to the needs of the community. If your community produces 100 tons per day of waste and a corporation is selling a plant that burns 1000 tons per day, they will have to import 900 tons of waste a day to keep the plant running efficiently. Where is that waste coming from? What roads will it travel to the plant? Account for the effects of potential recycling in determining the size of the plant.

Evaluate the health risks. Insist upon the need for monitoring of stack emissions. Because these emissions include heavy metals, acid gases, and possibly dioxins, the stacks should be equipped with the latest and best technology and should be monitored routinely. Very high temperatures are necessary to control dioxin emissions. Ascertain whether the state has limits on emissions and is enforcing them. Find out where the ash is to be dumped and how it is to be transported.

Effects on the Environment and Human Health

Water Contamination

Waste can pollute both groundwater and surface water. Landfills contribute to groundwater pollution in that they all leak sooner or later. When trash is put into a landfill, it is compacted both by machinery and by sheer weight. Aerobic microbes dissolve, rot, and change the character of the waste. When the oxygen has been used up, anaerobic microbes form new chemical compounds and produce methane gas. Rain trickles down through the mass picking up toxic metals and other contaminants which then may leach through the bottom of the landfill and percolate down into groundwater, in many areas the main source of drinking water. The New York Department of Environmental Conservation estimated in 1986 that half the state's 420 landfills were polluting groundwater. Other land disposal facilities also contribute to groundwater pollution.

The quality of surface water can be degraded by wastewater from municipal sewage treatment plants, industry, agriculture, and small businesses. As a result of Clean Water Act restrictions on industrial effluents, considerable progress has been made in cleaning up point source pollution of surface waters. Non-point source pollution, however, has hardly been addressed. Urban and agricultural runoff can be contaminated by pesticides, road salts and oils, car maintenance materials, and other toxics from small commercial establishments. These materials can leach into groundwater as well.

Aquatic systems when contaminated by refuse and untreated wastes endanger public health and wildlife. Sewage in drinking water supplies causes serious illnesses like giardiasis and hepatitis. Pollution of waterways and wetlands damages breeding grounds and contaminates otherwise edible fin and shellfish. Degradation of the habitat of a bird or insect can interrupt the food chain and result in overpopulation of one species—mosquitoes, for example, which can carry malaria or encephalitis.

Some 45,000 tons of plastic waste are dumped in the world's oceans every year.[7] As a result, there is unsightly pollution on shore, and marine life is threatened. Aquatic animals and fish can become trapped in or strangled by plastic fishing nets, plastic bags, and six-pack "yokes," or can die from ingesting them.

Photo: U.S. Fish and Wildlife Service, John Wilbrecht.

This ring-billed gull starved to death after it dived through a floating six-pack yoke.

Medical Waste

This component of municipal waste has attracted widespread public attention because of repeated incidents of pollution by hospital waste of beaches on the East Coast and increased concern about the transmission of communicable diseases. The source of this waste is difficult to trace, but illegal dumping is suspected. Hospital waste constitutes about 5,900 tons per day, much of which is burned in some 6,200 hospital incinerators. According to EPA some 15% of this waste is infectious.

Infectious wastes, generated by health care facilities, laboratories, and veterinary hospitals, are classified by states as hazardous, special, or solid wastes. They are disposed of mostly by incineration, but also in landfills or public sewers. About half the states require or are considering requiring pretreatment before land disposal but twelve states allow wastes to be placed in landfills without any pretreatment. Lacking federal regulation, 88% of the states are now or will be regulating infectious waste.

Sources: U.S. Environmental Protection Agency. *EPA Guide for Infectious Waste Management.* EPA/530-SW-86-014, May 1986. Council of State Governments. *State Infectious Waste Regulatory Programs.* CSG, 1988. "There's More Than Healed Bodies Coming Out of That Hospital." *Environmental Action,* July/August 1988.

Threats to the Land

When waste is disposed of in landfills, toxic materials not only contaminate the land area encompassed by the landfill but can migrate into soil beyond the disposal area. Almost a quarter of the sites listed on EPA's National Priorities List for clean-up under Superfund (see Legislation) are solid waste landfills.[8]

The conglomeration of dirty diapers, garbage, and discarded food containers can attract vermin that carry disease. Left uncovered, piles of old tires and spare parts provide a perfect breeding ground for mosquitoes and other insects that can carry germs to the surrounding population. Landfills are also susceptible to fires and methane gas explosions.

When waste is incinerated, areas even far from the site can be contaminated by airborne toxic emissions or by ash dispersed by air or water—for example, during transport in uncovered vehicles to landfills for disposal. Ash can contain high levels of toxic metals and dioxins as well. Small particles of ash are particularly susceptible to dispersal into the environment during handling, storage, transportation, or landfilling and are readily inhaled or ingested if exposure occurs. In addition, the toxic metals in ash are prone to leaching out, especially when the ash has been mixed with unburned waste, and, if disposed of improperly, can contaminate ground or surface waters.

Despite these risks, most ash has been and is still disposed of in ordinary municipal landfills, which are typically unlined, or stored in open piles. Ash is frequently carried in open vehicles and often is used to de-ice winter roads or to cover landfills, uses which greatly increase the chances for ash to be dispersed into the environment.

Air Quality Concerns

The burning of trash in mass burn incinerators releases numerous pollutants: acid gases such as hydrogen chloride, sulfur dioxide and nitrogen oxide; heavy metals such as lead, mercury, and cadmium; and the organic compounds, dioxins and furans, either as gases or absorbed into particulates. The possible environmental and health effects are many. Acid gases cause respiratory system diseases, are toxic to plants, corrode metals, and contribute to acid rain. Heavy metals carried by particulate emissions are detrimental to health even in small amounts. Lead and mercury can cause serious neurological disorders; cadmium and arsenic are probable carcinogens. Dioxins, formed mainly when waste materials such as chlorine-containing plastics, pesticides, bleached paper, and wood preservatives are burned, are extremely poisonous substances strongly suspected of causing cancer and birth defects.

Photo: Townsend/Greenpeace

Piles of Philadelphia incinerator ash.

Pollutants from Incinerators

Pollutant	Health and Environmental Effects
Acid Gases	
Sulfur Dioxide	Aggravates symptoms of heart and lung disease, including coughs and colds, asthma, bronchitis, and emphysema. Toxic to plants; can erode statues and corrode metals; precursor to acid rain.
Nitrogen oxides	High concentrations can be fatal; at lower levels, can increase susceptibility to viral infections such as influenza, irritate the lungs and cause bronchitis and pneumonia. Toxic to plants; precursor to acid rain.
Hydrochloric acid	Acts as an irritant to the respiratory tract and lungs; may cause laryngitis and bronchitis. May pose a danger to the ocean's micro-layer.
Organics	
Dioxins	High levels of exposure from industrial accidents have resulted in chloracne, altered liver function and skin disorders; EPA has listed 2,3,7,8-TCDD as a probable human carcinogen. Chickoedima disease in birds; linked to breeding failure in herring gulls.
PCBs	In high exposures, can cause chloracne, liver disorders and jaundice; may also cause birth defects.
Heavy metals	
Lead	In chronic or acute exposures, children may suffer neurological disorders and women may experience reproductive problems; probable human carcinogen according to EPA.
Inorganic mercury	Can cause serious neurological disorders and degenerative kidney problems; also linked to birth defects.
Cadmium	Probable human carcinogen according to EPA; may cause lung cancer; also linked to kidney disorders.
Chromium	May cause liver and kidney damage and respiratory disorders.
Arsenic	Probable human carcinogen according to EPA; may cause liver and kidney damage.

Source: "The Burning Issue: Making Municipal Incineration Safer." *Environmental Perspectives*. A Canadian Embassy Newsletter. Col. 1, No. 2, 1987.

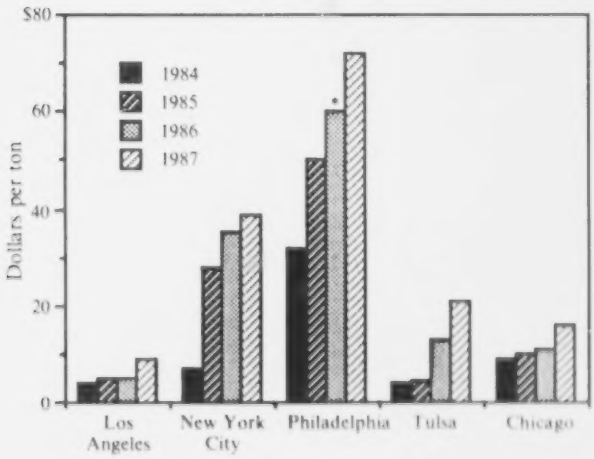
Uncovering Costs to Communities

In recent years the dramatic increase in waste disposal costs has forced many communities to look critically at present practices and possible alternatives. In order to make responsible decisions, planners and citizens must know the true cost of current waste management. This task is made difficult by accounting procedures that do not necessarily include all the expenses and by methods that vary from district to district.

Districts can use separate budgets, lump the expenses of several communities together, or list all the disposal costs under public works or in so many other categories that it is difficult to find them. Many related costs may not be listed under a waste disposal budget: capital costs; maintenance and repair of the facilities; employee benefits; liability or damage claims paid; or insurance premiums. Another hidden cost is the amortization of the costs of closing the current landfill or opening a new one.

The largest single expense has traditionally been for trash collection. In 1985 New York City paid $92 per ton to collect refuse and only $20 per ton to dump it.[9] Now, as landfill and incineration costs increase, the ratio of collection to disposal will most likely be reversed. Landfill tipping, or dumping, fees have risen sharply in most areas. In 1987 Boston's tipping fees jumped from $23 to $70 per ton.[10]

Tipping Fees at Selected Landfills: 1984-1987



*Estimated—data not available.

Source: *Beyond the Crisis: Integrated Waste Management*, Community Environmental Council, 1987.

Landfill tipping fees vary enormously from community to community. Many do not reflect the added expenses of insurance, audits, permits, fees, improvements, or the costs of future closure and the construction of a new landfill. In northeastern Vermont, improvements to bring a local landfill up to code are expected to cost $200,000 per acre.[11]

"Closing" a landfill is expensive. This process includes covering the site with layers of soil and clay and fitting it with monitoring devices that warn of excess gas or leaching into groundwater. Massachusetts estimates that $30,000 per acre is needed to cap a landfill.[12] Annual post-closure costs of monitoring and leachate treatment need to be calculated over 30 years and incorporated into the total costs.

> *"It's amazing how $50-75 tipping fees can make converts to recycling."*
>
> Jim Glenn,
> Contributing Editor of *Biocycle*

The costs of waste disposal to communities may not be limited to economic ones. Large-scale incinerators may cause health problems from emissions and blowing ash. Landfills have historically burdened a community by causing excess traffic on access roads, dumptruck noise, stench, problems with vermin, fires, and even explosions. The most serious problem is the possible contamination of a community's drinking water.

In addition, the land used for landfills or incinerators is land that could be used for other purposes. One reason landfill costs are escalating so rapidly is that land itself is becoming more precious as areas near cities are developed and as suburbs from neighboring cities begin to merge.

How Wastes Are Managed

Local Planning

Usually the local or regional government manages both the collection and the disposal of waste. Departments of Public Works normally administer the solid waste program, though other departments, Health or the Environment for example, may be involved.

The very efficiency of the local waste management structure in the US has enabled the professional managers to establish an institution that is now resistant to change. Existing interlocking financial, professional, and political considerations are so strong that it has been difficult to introduce new ideas. Millions of dollars have been invested in trucks, transfer stations, and disposal facilities; people have been carefully trained to fill only those slots that have traditionally been needed in a management hierarchy; politicians, understanding the delicacy of the whole waste management issue, have been very wary of trying out a technique that is drastically different from the ones that have served well enough in the past.

Communities that are developing integrated waste management systems will need to understand established practices as well as local needs in order to choose those technologies that provide both workable solutions and the flexibility to change as the community changes. In some instances, the term "integrated waste management system" has been used to justify low-level recycling and mass incineration.[13] In a truly integrated system, solid waste management is adapted to the specific conditions of the community: its size, its location, its economy, its population, and the composition of its waste stream.

Sources: U.S. Environmental Protection Agency; Radian Corporation. *Municipal Waste Combustion Study: Characterization of the Industry*. June 1987. U.S. Environmental Protection Agency; Alliance Technologies Corporation; Booz, Allen & Hamilton, Inc. *Subtitle D Study: Phase I Report*. October, 1986. *Newsday*.

State Initiatives

It has been difficult for states to implement the solid waste management plans they were required to draw up by the Resource Conservation and Recovery Act (RCRA) in 1976. In theory, EPA's acceptance of a state's plan qualifies it for federal funds for implementation, but in the 1980s limited funding or guidance have been available. Some states have done little, even allowing the continued use of open dumps, while others have developed innovative approaches such as mandatory recycling and source reduction programs.

"The real goal of integrated solid waste management is 80% materials recovery which provides the greatest contribution to the community's economic, environmental, and social well-being. Communities have already accomplished 60-70% materials recovery in the U.S. and Europe.

Neil Seldman,
Institute for Local Self-Reliance

In some states, the economic and environmental pressures of waste disposal are causing the responsibility for waste management to shift from the local to state level. For example, Maine has recently taken a more aggressive role in the management of waste in order to protect groundwater supplies used for drinking water and to assure that needs for future disposal facilities will be met.

Several states have established a waste management hierarchy that ranks options in terms of their desirability: reduction, reuse, recycling, incineration with resource recovery, and land disposal. In Oregon the Recycling Opportunity Act, which became effective in 1986, establishes strict priorities for local planners, resulting in several very successful integrated waste management strategies on the county level as well as one of the most successful recycling programs in the country.

State bureaus of solid waste can play an important role in the outcome of locally-run programs. They can offer technical assistance and incentives to municipalities and commercial establishments that are trying to achieve certain source reduction or recycling goals. The New Jersey Office of Recycling, for example, provides information and advice to those developing long-range plans. State procurement offices can boost the demand for recycled goods.

Some state recycling plans are mandatory, others make recycling services available to communities on a voluntary basis. Ten states have bottle bills, contributing to a 6-8% diversion of waste from landfills.* Some states are encouraging a regional approach. Massachusetts passed a Solid Waste Bill in 1987 authorizing the creation of regional entities throughout the state to coordinate waste management. This bill also provides funds for the acquisition of land and recycling equipment and for the establishment of composting programs.

Tax policy can also play a significant role. Oregon has used its 1967 Pollution Control Facility Tax Credit program to lower taxes for industries that recycle and to grant a tax saving on the purchase of equipment used for recycling. Savings have been used to expand recycling programs. North Carolina has initiated a tax credit for recycling equipment, and California is considering a 22% tax credit to companies that recycle waste oil.

The Federal Role: Inaction or In Action

Solid waste management has not been a high priority of the federal government in recent years. Funding for development of state plans steadily decreased in the late seventies and early eighties and in 1983 and 1984 there was no funding at all. In 1988 a small working group was set up in EPA to begin developing a comprehensive strategy for municipal solid waste management.

There are significant ways in which the federal government could affect waste management: establishing national recycling goals and packaging standards, adopting a clearly stated policy on source reduction, and implementing educational programs on all approaches to waste minimization. The federal government could also set an example for the states and stimulate markets for recycled products by fully complying with the twelve-year-old law requiring government purchase of products containing recycled materials.

*California, Connecticut, Delaware, Iowa, Maine, Massachusetts, Michigan, New York, Oregon, and Vermont.

New Directions: No Time to Waste

Source Reduction

Concentration on the best and most efficient methods for minimizing the generation of waste would eliminate many of the problems of waste disposal. Unfortunately, more than 99% of all federal government spending on the environment is for pollution control rather than waste minimization at the source, and for regulation rather than support of institutional changes: $1.5 billion was budgeted in 1988, of which only $398,000 was for waste minimization.[14] Some states, however, are giving source reduction first priority when formulating a waste disposal policy.

Reducing Wastes from Industrial Processes

Source reduction in industry has been limited for the most part to hazardous materials. The rising costs of disposal have stimulated efforts to reduce them. Similar cost increases for non-hazardous waste disposal may act as a strong incentive to reduce this kind of waste as well.

Some states have strong programs to help industries reduce hazardous waste. North Carolina has a source reduction program which saves industry in the state some $14 million a year in treatment and disposal costs through grants, technical assistance, research, and education. According to a program staff report, firms which receive technical assistance in the program can reduce their waste generation by 20-30%.[15] A survey of French companies trying to reduce waste internally showed energy savings in 51%, savings in raw materials in 47%, and improved working conditions in 40% of the plants.[16]

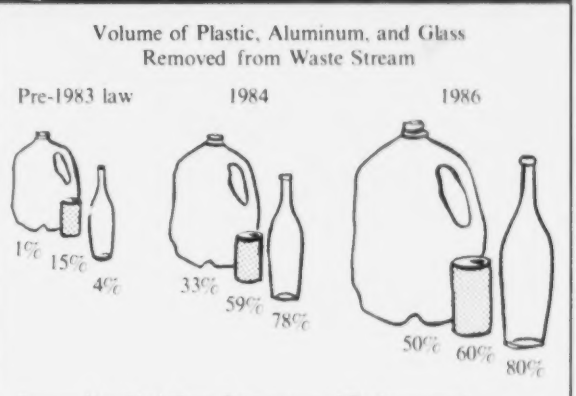
In 1988 Congress considered several bills to assist industry in reducing hazardous wastes at the source. EPA announced that it would make grants available to states to assist industries in developing source reduction and recycling. Funds may also be made available for a national data base of waste information and a national monitoring system to measure waste minimization.

The Packaging Battle

One of the best ways to reduce municipal solid waste is to cut down on packaging, which comprises about half of the volume and 30% of the weight of municipal waste. It accounts for 50% of all paper produced in the US, 90% of all glass, and 11% of all aluminum.[17] One dollar out of every $11 spent for groceries in the US pays for packaging.

In the mid-1970s Minnesota passed a Recycling Act which contained a statute that required review of new packaging to determine if it would constitute a disposal problem or be inconsistent with state environmental policies. This law, however, was challenged and has never been implemented. A Packaging Advisory Committee of the Minnesota Pollution Control Agency later concluded that the review was "impractical as an enforcement tool" but that public education and industry information programs would be valuable.

Impact of New York State Bottle Bill on Recycling Rate of Beverage Containers



Source: New York State Department of Environmental Conservation, Division of Solid and Hazardous Waste, March 1987.

Other states have passed legislation to control packaging including container deposit legislation or "bottle bills," taxes on various kinds of non-recyclable containers, and requirements for biodegradability in certain products.* Ten states require that six-pack yokes be made of photodegradable material.

In 1988 Berkeley, California, and Suffolk County, New York, banned the use of certain kinds of plastic packaging. Massachusetts passed a law in 1987 directing an investigation of the use of packaging and developing a system of tax incentives for businesses using recycled products. New Jersey may require that plastic packaging sold in the state be capable of degrading within three years. These bans or threats of

*The state of Washington proposed legislation in 1987 to require the use of biodegradable plastics for disposable diapers. Oyster Bay, New York, found that disposable diapers in their landfill accounted for as much waste as did bottles and cans. Sixteen billion diapers are sold each year, and only 67% of each diaper is biodegradable.

bans are stimulating industry interest in developing biodegradable plastics. As a result, products labelled as biodegradable or photodegradable—kitchen bags, for example—are beginning to appear in local markets.

Recycling: Refuse as Resource

Outmoded attitudes have influenced the way that individuals, communities, and the solid waste industry have treated waste. As long as people think that they can get rid of refuse safely, there is no particular incentive to reduce its volume or recycle it. However, if refuse is thought of as a resource, then ways can be found to retrieve, market, and use it.

"A conscious effort to change the function and image of the dump to a waste management facility supplying raw recyclable materials to buyers is a positive way for towns and cities to reduce their disposal costs."

Stephen Graefe,
New Hampshire Resource Recovery Association

Japan is recycling almost 50% of its waste, the US only 10%. Some US cities, however, are recycling as much as 25%. Philadelphia recently passed a mandatory recycling ordinance with a goal of a 50% recycling rate in four years. Increasingly states and communities have adopted some sort of recycling program. Three states (New Jersey, Rhode Island, and Connecticut) have mandatory recycling laws. Mandatory recycling with curbside pickup has proved to be the most effective method; for example, Woodbury, New Jersey has achieved a 45% recycling rate and a 90% participation rate.

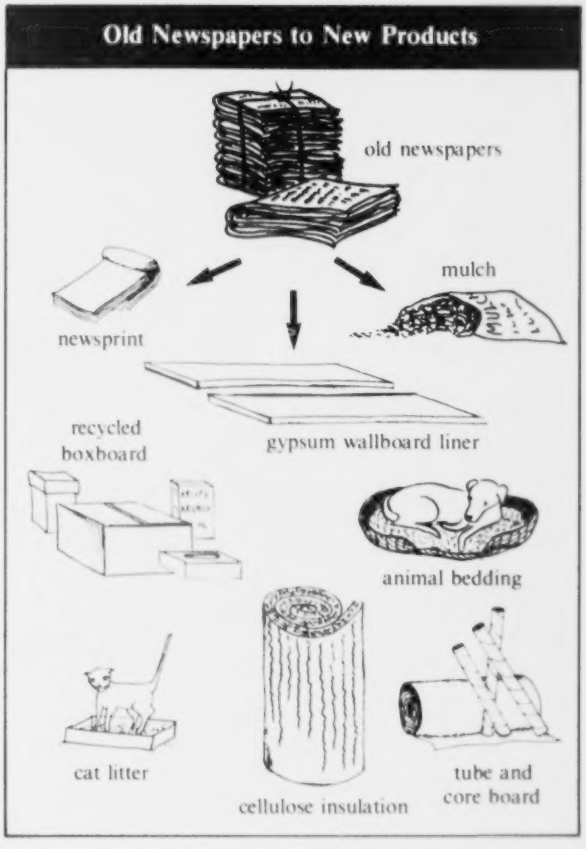
The benefits of recycling come not only from the sale of recycled materials and conservation of resources but also as a result of the reduced expenses from "avoided costs." The savings derived from not having to landfill the materials whic[h] are recycled should be included in any cost-benefit analysis of recycling. The costs of extending the life of a current landfill or of closing an old landfill and developing a new one must also be taken into account.

Recycling creates jobs. A report at the New York Recycling Forum in 1986 estimated that recycling 10,000 tons of material could create 36 jobs compared to six for landfilling the same amount.[18] Some communities have formed working partnerships with sheltered workshops for the disabled, developed and administered job training partnerships, or otherwise found work for unemployed labor in recycling programs.

What is Being Recycled?

Paper is probably the single most important item for a community to recycle in order to cut down on disposal costs and save landfill space. Even though it constitutes 40% of the volume of residential waste, only about 27% is recycled.

Since many communities have been recycling newspaper for years, there are already established markets. Although most waste paper goes to paper mills, several other industries use it for insulation materials, cushioning materials for packing and



shipping, and building products such as fiberboard. The main drawbacks to recycling paper are the fluctuation of market prices and the sludge that must be disposed of after the ink is removed.

An increasing number of states require their government offices to purchase recycled paper. EPA finally proposed guidelines for US government procurement of recycled paper in late 1987, twelve years after being required by law to do so. In a suit against EPA settled in April 1988, environmental groups forced EPA to change its guidelines which had mandated purchase of recycled paper only if its cost was close to that of non-recycled paper. Final guidelines are expected in 1988.

Environmental Benefits Derived From Recycling Materials

	Aluminum	Steel	Paper	Glass
Reduction (percentage)				
Energy Use	90-97%	47-74%	23-74%	4-32%
Air Pollution	95	85	74	20
Water Pollution	97	76	35	—
Mining Wastes	—	97	—	80
Water Use	—	40	58	50

Source: *Worldwatch Paper* No. 76, from *The Solid Waste Handbook*.

Most of the recyclable **metal** discarded in municipal solid waste is in the form of food and beverage cans, 89% of all cans produced. As of 1986 virtually all beer cans and almost 90% of soft drink cans were made of aluminum.[19] Since both aluminum and the energy needed to produce the products are expensive, the motivation for industry to recycle cans is high. The Aluminum Association estimates that about 50% of cans are currently being recycled yearly. Voluntary organizations raise nearly $300 million per year collecting and selling aluminum cans. The US Bureau of Mines estimates that 2.2 million tons of aluminum scrap were used in 1986: 45% by secondary smelters and 39% by primary producers.

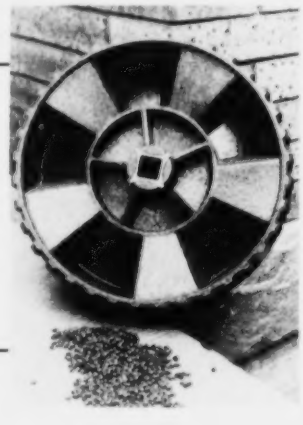
Food cans make up 37.3% of total can production.[20] These are generally steel or tin-coated steel and can be recycled. Recycled tin is especially sought after in the US since raw tin can only be obtained from foreign countries. It is separated chemically from the steel in cans; the steel scrap can then be sold to the steel industry.

Glass constitutes about 8% by weight of the waste stream. Some 40 billion bottles and jars were produced in 1987: one third contained food, one third beer, and the rest soft drinks and some pharmaceutical products. Such containers make up 20-40% of municipal waste glass and are the easiest for recycling centers to collect and handle. "Cullet," or crushed glass, can be used to make new bottles. Some other uses for cullet are glassphalt (a road paving material), building panels, and terrazzo. While resale value is low, markets are relatively stable.

The public perception of the abundance of **plastic** is much higher than its actual proportion of the waste stream by weight (6.5%).[21] Possibly this is because it is ubiquitous and usually non-biodegradable. Estimates of its proportion by volume are considerably higher—25-32%.[22] The plastics industry is growing very rapidly—the percentage of plastic replacements for other materials has been increasing by 5% per year. Plastics for food packaging are expected to double by 2000.[23]

Two plastics dominate the market: PET (polyethylene terephthalate) is the primary plastic for soda bottles, and HDPE (high density polyethylene) the usual component of milk jugs. Many containers made of plastic are actually made of multiple layers of different plastics, each contributing a specific quality (such as flexibility or transparency) to the final product. These are extremely difficult to recycle. Dyes or other coding systems to identify the plastic resins used in manufacturing would significantly aid efforts to recycle plastics. Wisconsin has proposed legislating such a system.

Plastics account for 11.5% (by weight) of packaging waste. Approximately one per cent of the 14.7 billion pounds of plastic packaging per year is recycled.[24] About 20% of the PET bottles are recycled (about 120 million pounds), and about 2% of HDPE, though HDPE constitutes almost four times as great a percentage of the waste stream as PET. The Plastics



Pellets of recycled plastic can be used to make a variety of things: here a child's wagon wheel.

Photo: Maggie Knaus

Recycling Foundation believes that potentially 1.3 billion pounds of mixed plastic waste can be turned into a variety of products including lumber, bleacher seats, and machine parts.[25] Two European firms have developed processes for converting mixed plastics into consumer goods, but these processes are not yet widely used.

Some plastics which are potentially recyclable are incinerated. Because they burn at a very high temperature and release a lot of energy quickly, plastic materials are much in demand by waste-to-energy plants. Burning plastic, however, can produce dioxins and other hazardous substances.

The emergence of the plastic can is likely to be more devastating to recycling efforts even than the plastic bottle. Not only is it very appealing to beer manufacturers, which could mean an enormous loss to aluminum manufacturers with their increasingly good record of recycling, but if the plastic cans, look-alikes for aluminum cans, accidentally get into a recycling system they can start fires in the smelters and damage equipment.

"For years, recycling has been hampered by the belief that it should make money. But recycling is a cost-effective disposal option if it requires fewer government subsidies than landfilling or incineration. Lower taxes, energy savings, and a cleaner environment are the real bottom lines."

Cynthia Pollock Shea,
Worldwatch Institute

Stimulating Markets

Finding outlets for recycled waste is a crucial element of a successful recycling program. For communities, a first step is to identify long-established local dealers.

Procurement programs can be particularly important. One highly successful operation is the state of Maryland's program, which has established guidelines for the buying of all kinds of supplies and equipment and encourages industry to label the percentage of recycled material in a given item. Another is a private, non-profit consulting program run by the Council for the Environment of New York City which encourages the recycling of office paper, helps to arrange pickups by recyclers, and provides advice to offices on buying recycled office supplies.

There are several other strategies states and localities have used successfully to develop markets. These include:

- establishing financial incentives such as tax credits or loans;
- finding buyers for locally-produced recycled products;
- exploring the development of new products made from waste—animal bedding from scrap paper, for example, or fiberfill from scrap plastic;
- promoting cooperative marketing programs like the one in New Hampshire where a private, non-profit organization puts recyclers and buyers of recycled products in touch with one another;
- building Materials Recovery Facilities—processing centers which turn out products more marketable than those from simple recycling centers.

Other Technologies

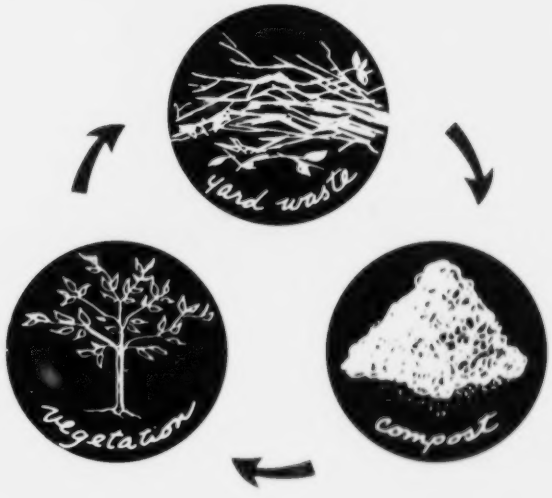
Materials Recovery Facilities (MRFs) or **Intermediate Processing Centers** (IPCs): These are large, regional processing centers which have the same function as recycling centers but which are technologically more sophisticated. They accept only recyclable materials which are then sorted and cleaned in an automated system. The resulting products are of high quality and therefore easy to market. Several northeastern states, Connecticut and Massachusetts for example, have MRFs or are planning to build them.[26]

Some companies are developing other processing systems which, unlike MRFs, accept mixed waste (rather than recyclables only) that they process into reusable materials, compost, and refuse-derived fuel. Some of these facilities require neither incineration nor landfills.

Composting: Large-scale composting has begun to emerge as a new application of an ancient technology—piling up organic plant matter or animal

manure and, with the addition of water, producing tons of humus to add to soil. The largest single compost operation in the world, in the Netherlands, produces 125,000 tons of compost from refuse yearly.[27] France has over 100 plants producing 800,000 tons per year. Other European countries also produce compost. Much of this is exported to the Arabian Peninsula where the need for topsoil outstrips its supply.[28]

Many North American communities have begun to compost lawn and yard waste and treated sludge. While about 500 communities nationwide compost yard waste, which can be 30% of a typical waste stream, and about 200 currently are composting sludge, large-scale applications of composting techniques are still being developed.[29] Palo Alto, California, has composted yard wastes since 1979; it uses the compost as cover for its landfill. Portland, Oregon, plans to compost 400 tons per day. Seattle composts all of the manure produced by the city zoo animals.



Methane: Commercial plants at landfills are reclaiming and using methane, the highly-flammable gas produced by bacterial action and present under virtually all established landfills. A $750,000 methane-to-electricity conversion system, for example, is operating at the Al Turi landfill in Goshen, New York. The system recovers methane via 25 wells positioned in the closed landfill.[30] There is also a new technology which combines paper fiber and organics to produce methane after source separation and mechanical processing have taken place.[31]

How To Determine a Recycling Policy

Analyze your community's waste stream and determine its components. Target those items that make up the greatest share of the waste stream. Use a system that is appropriate for your specific needs.

Cooperate with as many neighborhoods or towns as possible. This helps to generate enough materials to stimulate markets.

Locate markets for your recycled goods before you start. Get in touch with existing scrap dealers in your community since they have already established markets; consult with communities that are already in the market.

Encourage citizen cooperation. Generally, mandatory recycling works best; citizen-sorted recyclables picked up at the curb with the regular collection results in the highest participation rate.

Consult with your regular trash haulers to determine any extra equipment and personnel needs.

Support government programs. Initiate them where they do not exist. Procurement programs, requiring the local government to buy goods with a high recycled content, bolster the market for scrap materials; tax incentives ease industry's transition to using scrap materials; differential taxes on non-recyclable goods provide funds to be used for recycling research or implementation; and, perhaps most importantly, a strong public education program encourages widespread acceptance.

Integrate recycling into any large-scale or long-term waste disposal plan in your community. If an incinerator is to be built, make sure that it will not take recyclables; if new landfills must be opened, consider how a recycling center will fit into the design.

Evaluate the program regularly. Get feedback from the waste haulers, scrap dealers, educators, and citizens themselves. Keep the program flexible enough to respond to changes in the waste stream, the market, or the community's needs.

Legislation

The only legislation covering the management of non-hazardous solid waste is the **Resource Conservation and Recovery Act (RCRA)** of 1976. Intended primarily to protect human health and the environment from the improper management of hazardous waste, it also directs EPA to provide states with technical assistance and funding to develop solid waste management plans, protect groundwater from contamination by waste, and close open dumps.

In the 1970s the federal government gave scant attention to developing a sound solid waste management plan. Its support of other forms of waste management, including incineration, discouraged recycling. EPA's funding for solid waste management steadily decreased from 1976 to 1982; in 1983 and 1984 there was no funding at all. In many cases, this has discouraged states from implementing the solid waste plans approved by EPA in the late 1970s.[32]

Implementation of provisions in the law to conserve resources and to encourage the maximum use of materials recovered from waste has been slow. EPA was required to draw up guidelines for federal agencies to procure products containing the highest percentage feasible of recovered materials. Only two of these guidelines were drafted by 1987. Environmental groups brought suit, and in April 1988 a federal court compelled EPA to complete guidelines and regulations for purchase of other recycled products including tires, insulation, and lubricating oils.

The hazardous waste provisions of the law require the tracking of hazardous waste from generation to disposal ("cradle-to-grave") by means of a manifest system. Treatment, storage, and disposal facilities must have permits which state the potential for public exposure. Exemption of household waste from the hazardous waste provisions of the law has allowed the toxic component of municipal solid waste to be disposed of in landfills that are ill-equipped to handle it.

The **Hazardous and Solid Waste Amendments (HSWA)** of 1984 authorize EPA to develop new standards for landfills receiving non-hazardous waste to ensure that they adequately protect human health and the environment from groundwater pollution. Draft regulations would require new municipal solid waste landfills to include double liners, leachate collection systems, and final cover systems as necessary to achieve these performance standards. These amendments establish a timetable for processing permits for all waste facilities: landfills within four years, incinerators five, and all others within eight.

The **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund)** of 1980 provides for federal government clean-up of chemical spills and inactive toxic waste sites that may pose threats to human health or the environment. As of April 1988 only 16 of 799 priority sites had been cleaned up. EPA's total list of Superfund sites numbers 26,000 but this number may increase by as much as 2,500 due to the closure of many facilities that treat, store, or dispose of hazardous waste because of inability to meet the new HSWA regulations.[33]

Under the **Superfund Amendments and Reauthorization Act (SARA)** of 1986 wastes must be treated to the maximum extent possible and remedial actions must be permanent solutions rather than the stopgap measures that have prevailed in the past. In other provisions, operations that manufacture, process, import, or use a defined quantity of toxic chemicals per year are required to report on the amounts of chemicals released to air, water, and land either through routine operations or by accident. This information must be provided to both EPA and the state in which the facility is located. It will be available to citizens through the Toxic Release Inventory (TRI) database.

The **Clean Water Act (CWA)** of 1972 is designed to restore and maintain the quality of surface waters through a permitting system called the National Pollutant Discharge Elimination System (NPDES). This system regulates the amounts of contaminants which can be released in industrial effluents.

This Act affects waste management both from the perspectives of point source and non-point source pollution. Liquid waste discharges from some industrial plants and municipal incinerators go either directly to surface waters or to wastewater treatment systems ill-equipped to deal with them. The 1987 amendments provide $18 billion over the next six years for the construction of sewage treatment plants and require states to identify toxic "hot-spots" and to develop plans for their clean-up. The law also requires EPA to identify and set numerical limits for toxic contaminants in sewage sludge by mid-1988. The amendments authorize $400 million to help states reduce non-point source pollution. Among the sources the states will have to control are leaking solid waste landfills.

The **Clean Air Act (CAA)** of 1963 as amended in 1970 and 1977 requires EPA to identify air pollutants and set standards for their presence in the general atmosphere (ambient air). Standards issued in 1974

for emissions of particulate matter (dust, smoke, and ash, all of which can carry pollutants) apply to incinerators built after 1971 which burn more than 50 tons per day of municipal solid waste. Incinerators are also subject to other limitations based on the anticipated effect they will have on ambient air. In areas where National Ambient Air Quality Standards are not being met, before a new incinerator can be built, it is the responsibility of the new plant to locate a source which has already reduced its emissions. This "offset" can be achieved by closing an existing facility, for example, or using more efficient technology to reduce emissions at another plant. Environmental impact assessments are required before permits can be issued.

There are at present no controls specific to municipal solid waste incinerator emissions (except for certain limits on the concentration of particulates) and none for ash management. Proposed amendments to the CAA would require EPA to set performance standards for emissions of about 20 substances from municipal solid waste incinerators and would set absolute standards for particulate matter, carbon monoxide, hydrogen chloride, and sulfur dioxide. The technology that would be required to control these emissions is considered to be effective in reducing the emissions of dioxins. The proposed requirement that combustion temperatures be not lower than 1800 degrees is also directed at dioxin reduction, although there is some concern that other problems may result. The proposed amendments would also direct EPA to draw up plans for the storage, transportation, reuse, and disposal of ash.

State and Local Programs

Source Reduction Initiative

Rhode Island, though planning to build three incinerators, has also taken some significant steps toward integrated waste management and elaborated some innovative ideas for reducing waste. In 1987 the Rhode Island Source Reduction Task Force released the nation's first statewide source reduction plan which attempts to increase the life spans, reusability, and recyclability of products as well as the use of recycled materials. A four-pronged approach includes the education of manufacturers, consumers, and students; regulation to ban certain products from state purchasing; legislation for increased recycling; and technical assistance to businesses for waste reduction.

The Rhode Island Solid Waste Management Corporation (RISWMC), which has the authority to plan and direct solid waste management activities in the state, has established a deposit on vehicular batteries to encourage recycling and a labeling method to inform consumers of a product's recyclability. It is also considering a number of approaches including incentives such as tax credits and disincentive regulations such as material production bans, taxes on owners and operators of waste disposal facilities, deposits on products, and product specifications. Public education in source reduction is an integral part of the program. Phased-in mandatory recycling is planned. Pilot recycling programs have begun in East Greenwich and West Warwick where newspapers, aluminum, metals, glass, and plastic milk and soda bottles are being collected. Rhode Island's 39 communities are all expected to be phased into the program by 1990.

State Recycling and Source Reduction

When faced with closing landfills, Connecticut initially made a commitment to incineration. By 1987, however, as a result of citizen pressure, the state took an important step toward integrated management. A law was enacted creating a schedule for the reduction of 25% by weight of Connecticut's solid waste. Other legislation mandates that by January 1, 1991, no materials designated recyclable by the Department of Environmental Protection (DEP) will be allowed into landfills or waste-to-energy facilities.

The DEP is calling for regional plans to reach these goals. Intermediate Processing Centers, serving 250,000 to 400,000 people, will collect and prepare for marketing mixed recyclable materials from households and businesses. Plans include providing containers to households for glass and cans and curbside pickup of these items and bundled papers.

Children are educated about recycling through the visits of a promotional figure named "Ray Cycle" to schools throughout the state. Expansion of the program to include the recycling of other materials (such as plastics) is planned upon establishment of markets.

In 1988 the Connecticut legislature passed a bill expanding the recycling program by setting requirements for the state government. These include timetables and guidelines for what the state must recycle and require the state to make provisions for recycling when constructing new buildings or renovating old ones. This legislation also bans cans made of a combination of metal and plastic (which are difficult to recycle) from Connecticut stores and stipulates that certain plastic bottles be labeled as to their composition so that they can be returned to the appropriate recycling plant.

Photo: Luke Sterner

Volunteers collect recyclables at Washington's Dupont Circle Neighborhood Ecology Center (DCNEC).

City Recycling

San Francisco at present recycles 25% of its waste. As a part of its Solid Waste Management Program, established in 1979, the city undertook to recycle as much waste as possible by working with the private sector on such diverse programs as recycling office paper, newspapers, mixed waste paper, wood waste, metals, wine bottles and other glass collected from bars and restaurants, and composting animal waste from the San Francisco zoo.

A variety of collection methods are employed. Residents sort out newspapers, which are then collected by garbage trucks. Commercial enterprises

Photo: Maggie Knaus

Zoo animals provide a new source of fertilizer.

separate cardboard, much of which is collected by scavengers. All large chain stores have cardboard balers.

In 1986 the city hired four public relations firms to advertise recycling in four different communities within San Francisco. One of these campaigns, called "Recycle for Life," was directed at the gay community and encouraged recyclers to donate their proceeds to the AIDS Foundation. Another campaign encouraged citizens to ask for paper bags at the grocery store and stressed the use of these bags to collect and carry recyclables. A Christmas Tree Recycling Program was started in 1988.

The success of this program can be attributed to its diversity and its flexibility. It is an integrated system based on the recycling programs already in place and convenient to use. It has a major public education component. In 1987 a School Recycling Education Coordinator was appointed to introduce a kindergarten-through-fifth grade recycling curriculum, "the 4th R," into city schools.

Plastic Packaging Ban

On April 29, 1988, Suffolk County, New York, passed legislation—the most far-reaching of its kind in the US—to ban plastic grocery bags and many plastic food containers in the county as of July 1989. Polystyrene, or plastic foam, is banned as is polyvinyl

chloride, used for plastic wrap. This type of packaging is not biodegradable. Fast food restaurants will be required to serve hamburgers and other foods in paper materials. Restaurants, bars, and grocery stores are also forbidden to use plastic packaging materials. Goods shipped into Suffolk County packaged or wrapped in plastic are not affected by the law.

"One-Stop" Recycling Center

On the grounds of an abandoned municipal incinerator the town of Wellesley, Massachusetts, has created a unique recycling center. Bottles, cans, clothing, appliances, tires, used motor oil, and batteries are collected indoors. Outside, grass clippings and leaves are composted, and recyclers can help themselves. There is a "take it or leave it" section where unwanted items—anything from lawn mowers to lumber—are left for others who might be able to use them. There is even a book exchange.

Over 80% of Wellesley's 23,000 residents now recycle. Estimated savings to the town for the fiscal year ending June 30, 1987 were about $262,000 through sales of recycled materials and avoided landfill costs. Recycling expenses of $45,000, which included a continuing education program, yielded a net gain of $217,000.[34]

Various household batteries are undesirable in the waste stream because they contain heavy metals and chemicals that can be environmentally harmful and injurious to humans. These substances can enter the environment as leachate from landfills or via incinerator emissions. Many heavy metals such as mercury, lead, copper, zinc, cadmium, manganese, nickel, and lithium make up some of the components of household batteries.
Source: *Resource Recycling*, PO Box 10540, Portland, OR 97210.

Community Action

An Alternative to Incineration

In early 1986 a resident of one of the oldest residential areas of Lowell, Massachusetts, found out that the city was planning to build a mass burn incinerator in her neighborhood. With a group of other concerned citizens, she formed the Highland Council to look into the matter. At that time studies of incinerators did not exist, so Council members had to research the subject. They discovered that, while Lowell generates only approximately 250 tons of waste a day, the proposed incinerator would burn 1500 tons, meaning that waste would have to be imported from other communities to assure efficient operation. A 1500 ton incinerator would produce 300-400 tons of ash daily which would have to be disposed of safely. Also, significant amounts of arsenic, lead, cadmium, soot, and ash would be emitted even after "best available technology" was in place.

The Council then printed a flier which contained basic information about the size of the proposed incinerator, the number of trucks which would be delivering waste, and the toxicity of emissions and ash. The writers were careful to express themselves in language which would mean something to their readers; for example, when describing the size of the facility, rather than using acreage, they described it as being as large as two football fields. This flier was distributed door-to-door through the neighborhood and announced an upcoming organizational meeting.

Lowell had at that time been going through a period of economic recovery. The city had been promoting business and the rebuilding of downtown areas to what was perceived as the detriment of residential areas. As a result, the first meeting was attended by 100 people. Further meetings were held with experts. A telephone tree was organized which could be activated at critical junctures. The Highland Council was also successful in involving all the other neighborhoods in the city. Eventually, the City Council, which at first did not take the work of the neighborhood council seriously, defeated the mass burn proposal. It was defeated again in a subsequent referendum.

Crucial to the successful outcome of this effort was that the neighborhood council, while it fought the incinerator, was working with the city to find an alternative. It also gained credibility by pointing out that it was not against the siting of any facility in the neighborhood—only a mass burn incinerator. The city has decided to build a recycling center in the same location and to mandate household waste separation.

A Regional Recycling Center

In the late 1970s the state of New Hampshire ordered the closing within two years of the landfill serving the town of Wilton. The choices open to the town included setting up a transfer station (where waste is held temporarily for transport), buying an incinerator to burn all the waste, or recycling as much as possible and burning the remainder. Momentum built toward the recycling option, in part because of an educational pamphlet distributed throughout the community which stressed that it was the least expensive alternative. In the end Wilton chose an integrated system involving recycling and incineration.

It was soon obvious that to build a recycling center and an incinerator it would be necessary to share the cost with other towns in the area. The six towns which joined together and now make up the Solid Waste District signed a ten-year contract which created a policy committee with one voting member per town and a shared cost and revenue plan based on town populations.

In 1978 the towns agreed that mandatory source separation would be a condition for using the Wilton Recycling Center. In 1986 the net cost for running this drop-off center—used by some 65% of the population—was $13.70 per capita compared to neighboring communities' average cost of $35 per capita. About 45% by weight of the waste handled by the Center was recycled. The yearly benefit to the towns—including recycling profits and avoided costs—is about $100,000 per year. There are four full-time employees and occasional volunteer help.

Like many recycling operations, the Wilton Center had difficulty at first selling its recycled materials. Part of its success in overcoming this problem was due to the formation in 1981 of the New Hampshire Resource Recovery Association (NHRRA), a private, non-profit organization that assists communities and businesses in promoting environmentally-sound solid waste management practices. The NHRRA acts as a statewide broker between recyclers and buyers of recycled materials and provides technical assistance and educational programs to its members.[35]

The Wilton Recycling Center in New Hampshire provides bins for different recyclables, including books.
Photos: Charles Knox

Guidelines for Action

Find out about your community's waste

- How much waste and what kind is generated in your community? Gather accurate data from your Sanitation, Public Works, or Environmental Resources Department.
- Who collects the trash? How is it collected? How is it disposed of? Does your community bury, burn, or recycle its trash?
- Who is responsible for waste management? Is more than one government agency involved?
- What is the local budget for solid waste management? Has it increased in recent years? Has it assumed a larger proportion of the community budget relative to that for education, fire-fighting, and police?
- What local ordinances or regulations cover waste disposal? Are they stronger than the federal regulations under RCRA and HSWA? Is there a "flow control" ordinance? Does it guarantee a predetermined amount of trash to incineration or to materials recovery facilities? Does it include an allowance for recycling?
- Does your community have an integrated waste management plan? Does it take into account future growth? Are planners working with other nearby communities on regional waste management plans? Have they studied the waste management plans of other states and communities?

What disposal options are available?

- Does your community use landfills? Where are they located? Are they being monitored for groundwater contamination? Is a drinking water source being affected?
- How are your landfills constructed? Have they been or are they going to be upgraded to include multiple liners, leachate collection systems, monitoring wells? How soon will they be filled? How much does it cost to dump a ton of waste in your landfill? Does any landfill space remain open in your area?

Has a municipal incinerator been proposed for your community?

- What kind of incinerator is it? Mass burn? Waste-to-energy?
- Will recyclables and hazardous substances be removed before burning?
- What contaminants may be released as air emissions or contained in the bottom or fly ash? In what amounts? How will they be controlled?
- Find out whether the best available technology will be used: baghouse? scrubbers? maximum temperature to control emissions?
- How many tons a day will the incinerator burn?
- Will the incinerator depend on importing waste from other communities to meet this capacity?
- How much ash will there be relative to the amount of waste burned? How will it be handled?
- How much water will be needed per day? Will it be discharged? Where? How will water contamination be prevented?
- Who has invested in this endeavor and who will collect the profit?
- How much will it cost to burn one ton of waste?

- Have the costs of alternative disposal methods been calculated and compared? Have the avoided costs achieved by recycling and reuse been factored into the analysis?
- How many years must it operate in order to pay for itself?
- Does the incinerator corporation have liability insurance?
- Has your community looked into Materials Recovery Facilities?

If you have a recycling program:

- What percentage of the waste generated is or could be recycled?
- What materials are recycled? Are they taken to recycling centers or are they picked up at the curb? Is there a requirement to separate them before they are picked up or deposited at a center?
- What markets exist or could be developed for recycled materials?
- Are leaves and yard trimmings composted?
- Are there household hazardous waste collection days in your community? Are there designated places in your community where you can take used motor oil? batteries?
- Are local industries reusing or exchanging waste?
- Do commercial establishments recycle office paper and corrugated cardboard?
- Must government agencies give priority to the procurement of recycled materials? Do businesses have incentives to do likewise?

Organize a recycling program if none exists

- Know your community's waste components. Analyze your specific needs.
- Contact nearby recycling groups, private recyclers, government agencies, national recycling organizations.
- Study successful recycling programs in other communities and materials on how to start a recycling program. (See Resources and Selected Reading.)
- Identify materials for recycling. Consider a community composting program, community exchange.
- Examine potential markets. Find out whether a market survey has been conducted by your state; in your region.
- Establish a public education program.
- Involve all areas of the community. Hold informational meetings and invite experts to speak.
- Identify available resources for planning and policy: government agencies, consultants, environmental groups, civic groups.
- Work for mandatory curbside recycling, a bottle bill, tax incentives for recycling, household hazardous waste collection days.

Set an example

- Purchase the least packaged items; ones which are recyclable; non-toxic; biodegradable.
- Ask for paper bags instead of plastic, or bring a reusable bag when shopping.
- Reuse your glass jars, cardboard boxes, paper bags.
- Take newspapers, cans, bottles to a recycling center.
- Compost food and/or yard wastes.
- Dispose of leftover household toxics at collection days if such exist.

What is your state doing?

- Is it implementing its solid waste management plan?
- Does it have a source reduction program? a goal for recycling?
- Is technical or economic assistance available to communities for source reduction programs?
- Does it give grants to community groups for small-scale efforts?
- Has it established product disposal charges; that is, does it require that the costs of products include the cost of disposal?
- Does your state have or is it considering container deposit legislation? legislation either to ban or restrict certain types of packaging? tax incentives for recycled product users? How would it achieve compliance?
- Does it have a procurement program?
- Does the state require institutions, such as schools and government agencies, to use reusable containers?
- Has it done a market survey for recyclable materials?
- Is there a state education program on recycling? source reduction? household hazardous waste?
- Do other states dump in your area?

Support federal initiatives:

- a national recycling task force; mandatory source separation; a national bottle bill; tax breaks on recyclables; the development of markets for recyclables; procurement programs; national minimum recycling rates;
- an explicit waste reduction policy;
- a national waste data base;
- waste-to-energy controls including standards for air emissions, improved monitoring and testing, regulations for ash disposal; guidelines for "flow control" regulations which would allow for maximum recycling.

Resources

National Organizations

Association of New Jersey Environmental Commissions
300 Mendham Road
Mendham, NJ 07945
(201) 539-7547

Citizen Action Network
1300 Connecticut Avenue NW, Room 401
Washington, DC 20036
(202) 857-5153

Coalition for Recyclable Waste
17 East Church Street
Absecon, NJ 08201
(609) 641-2197

Environmental Action Foundation
1525 New Hampshire Avenue NW
Washington, DC 20036
(202) 745-4870

Environmental Defense Fund
257 Park Avenue S.
New York, NY 10010
1616 P Street NW
Washington, DC 20036
Recycling Hotline: 800-CALL EDF

INFORM
381 Park Avenue South
New York, NY 10016
(212) 689-4040

Institute for Local Self-Reliance
2425 18th Street NW
Washington, DC 20009
(202) 232-4108

National Center for Policy Alternatives
2000 Florida Avenue NW
Washington, DC 20009
(202) 387-6030

Natural Resources Defense Council
122 East 42nd Street, 45th Floor
New York, NY 10168
(212) 949-0049

Pollution Probe Foundation
12 Madison Avenue
Toronto, Ontario M5R-2S1
(416) 926-1907

Resource Policy Institute
P.O. Box 39185
Washington, DC 20016
(202) 895-2601

USPIRG
215 Pennsylvania Avenue SE
Washington, DC 20003
(202) 546-9707

Integrated Waste Management

Gildea Resource Center
Community Environmental Council
930 Miramonte Drive
Santa Barbara, CA 93109
(805) 963-0583

Natural Resources Council of Maine
271 State Street
Augusta, ME 04330
(207) 622-3101

Recycling Information/Materials

Alabama Conservancy
2717 7th Avenue South
Suite 201
Birmingham, AL 35233
(205) 322-3126

Center for the Biology of Natural Systems
Queens College CUNY
Flushing, NY 11367
(718) 670-4180

The Connecticut Citizen Action Group
51 Van Dyke Avenue
Hartford, CT 06106
(203) 527-7191

Florida Sierra Club
Dr. Dwight Adams
2905 NW 12th Place
Gainesville, FL 32605
(904) 392-0485

King County Solid Waste
450 King County Administration Building
500 4th Avenue
Seattle, WA 98104
(206) 344-3842

The Minnesota Project
A Center for Public Policy Study and Community Development
2222 Elm Street SE
Minneapolis, MN 55414
(612) 378-2142

National Recycling Coalition
P.O. Box 80729
Lincoln, NE 68501
(402) 475-3637

New Jersey Department of Environmental Protection
Division of Solid Waste Management: Recycling
CN414
401 East State Street
Trenton, NJ 08625
(609) 292-0331

Office Paper Recycling Service
Council for the Environment of New York City
51 Chambers Street, Room 228
New York, NY 10007
(212) 566-0990

The Ohio Alliance for the Environment
445 King Avenue
Columbus, OH 43201
(614) 421-7819

Philadelphia Recycling Office
14th Floor, City Hall
Philadelphia, PA 19107
(215) 686-5586

Recycle Now!
1873 South Bellaire, Suite 510
Denver, CO 80222
1-800-438-8800

Texas Committee on Natural Resources
5934 Royal Lane, Suite 223
Dallas, TX 75230-3803
(214) 368-1791

Successful Recycling Programs

City Hall
33 Delaware Street
Woodbury, NJ 08096
(609) 845-1300
(45% recycling rate)

City of Berkeley
Department of Public Works, Recycling Division
2180 Milvia Street
Berkeley, CA 94704
(415) 644-6523

Department of Public Works
425 East State Street
Rockford, IL 61104
(815) 987-5571
(Cash for Trash Program)

Portland Recycling Team
2005 North Portland Boulevard
Portland, OR 97217
(503) 228-5375

Solid Waste Management Program
City Hall, Room 271
San Francisco, CA 94102
(415) 554-6194

Village of Hamburg
100 Main Street
Hamburg, NY 14075
(716) 649-4953
(98% compliance: sticker program)

Procurement

Maryland Energy Office
45 Calvert Street
Annapolis, MD 21401
(301) 225-1810
Richard Keller, Chairman of MD Recycling Coalition

Wastewater

Water Pollution Control Federation
Public Education Department
601 Wythe Street
Alexandria, VA 22314-1994
(703) 684-2400

Hazardous Waste

Citizen's Clearinghouse for Hazardous Waste
P.O. Box 926
Arlington, VA 22216
(703) 276-7070

Massachusetts Campaign to Clean Up Hazardous Wastes
29 Temple Place
Boston, MA 02111
(617) 292-4821

Toxics Project
New York Public Interest Research Group (NYPIRG)
9 Murray Street
New York, NY 10007
(212) 349-6460

Household Hazardous Waste

Center for Environmental Management
Tufts University
474 Boston Avenue
Curtis Hall
Medford, MA 02155
(617) 381-3486

Ecology Center of Ann Arbor
417 Detroit Street
Ann Arbor, MI 48104
(313) 761-3186

Household Hazardous Waste Project (HHWP)
901 South National Avenue, Box 87
Springfield, MO 65804
(417) 836-5777

Source Reduction

Hazardous Waste:

Local Government Commission
Communities Controlling Toxics
909 12th Street, Suite 203
Sacramento, CA 95814
(916) 448-1198

Waste Energy Management Board
1350 Energy Lane
Saint Paul, MN 55108
(612) 649-5750
Within Minnesota:
1-800-652-9747
used tire hotline: 1-800-228-1339

Municipal Solid Waste:

Clerk of the Legislature
Building 20
Veterans Memorial Highway
Hauppauge, NY 11788
for copies of the plastic ban legislation:
(516) 360-4088
Sondra Bachety

Rhode Island Solid Waste Management Corporation
West Exchange Center
260 Exchange Street
Providence, RI 02903
(401) 831-4440

Incineration Information

Massachusetts Public Interest Research Group (MASSPIRG)
29 Temple Place
Boston, MA 02111
(617) 292-4800

Northern Sun Alliance
1519 East Franklin Avenue
Minneapolis, MN 55404
(612) 874-1540

Work on Waste
82 Judson Street
Canton, NY 13617
(315) 379-9200
(also information on recycling)

Marketing

Illinois Department of Energy and Natural Resources
325 W. Adams Street, Room 300
Springfield, IL 62704-1894
(217) 524-5454

Michigan Department of Natural Resources
P.O. Box 30028
Lansing, MI 48909
(517) 373-0540

New Hampshire Resource Recovery Association
P.O. Box 721
Concord, NH 03302
(603) 224-6996

Pennsylvania Department of Environmental Resources
P.O. Box 2063
Harrisburg, PA 17120
1-800-346-4242

State Waste Agencies

Daniel E. Cooper
Land Division
Alabama Department of Environmental Management
1751 Federal Drive
Montgomery, AL 36130
(205) 271-7730

Stan Hungerford
Air and Solid Waste Management
Department of Environmental Conservation
Pouch O
Juneau, AK 99801
(907) 465-2666

Ronald Miller
Office of Waste and Water Quality Management
Arizona Department of Environmental Quality
2005 North Central Avenue, Room 304
Phoenix, AZ 85004
(602) 257-2305

Mike Bates
Hazardous Waste Division
Arkansas Department of Pollution Control and Ecology
P.O. Box 9583
8001 National Drive
Little Rock, AR 72219
(501) 562-7444 x504

Alex Cunningham
Department of Health Services
State of California
714/744 P Street
Sacramento, CA 95814
(916) 323-2913

David C. Willis
Toxic Substances Control Division
Department of Health Services
Sacramento, CA 95814
(916) 324-1826

James Easton
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95801
(916) 445-1553

Joane Sowinski
Waste Management Division
Colorado Department of Health 4210 E. 11th Avenue
Denver, CO 80220
(303) 320-8333 x4364

Stephen Hitchcock
Hazardous Material Management Unit
Department of Environmental Protection
State Office Building
165 Capitol Avenue
Hartford, CT 06106
(203) 566-4924

Marian R. Cherton
Connecticut Resource Recovery Authority
179 Allyn Street, Suite 603
Professional Building
Hartford, CT 06103
(203) 549-6390

Gary Molchan
Department of Natural Resources and Environmental Control
P.O. Box 1401, 89 Kings Highway
Dover, DE 19903
(302) 736-4764

Angelo Tompros
Pesticides and Hazardous Materials Division/Superfund
Department of Consumer and Regulatory Affairs
5010 Overlook Avenue, S.W., Room 114
Washington, DC 20032
(202) 767-8414

Raoul Clarke
Solid and Hazardous Waste Underground Storage Tanks
Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32301
(904) 488-0300

John D. Taylor, Jr.
Land Protection Branch
Industrial and Hazardous Waste Management Program
Floyd Towers East
205 Butler Street, S.E.
Atlanta, GA 30334
(404) 656-2833

Denis Lau
Department of Health
Hazardous Waste Program
P.O. Box 3378
Honolulu, HI 96801
(808) 548-6410

Cheryl Koshuta
Hazardous Materials Bureau
Department of Health and Welfare
Idaho State House
Boise, ID 83720
(208) 334-5879

Nancy Simpson
Division of Land Pollution Control
Environmental Protection Agency
2200 Churchill Road
Springfield, IL 62706
(217) 782-6760

Nancy Maloley
Indiana Department of Environmental Management
105 S. Meridian Street, P.O. Box 6015
Indianapolis, IN 46225
(317) 232-3210

Luetta Flournoy
Hazardous Materials Branch
U.S. EPA Region VII
726 Minnesota Avenue
Kansas City, KS 66101
(913) 236-2888
(For Iowa)

Dennis Murphey
Bureau of Waste Management
Department of Health and Environment
Forbes Field, Building 321
Topeka, KS 66620
(913) 862-9360 x290

J. Alex Barber
Division of Waste Management
Department of Environmental Protection
Cabinet for Natural Resources and Environmental Protection
Fort Boone Plaza, Building #2
18 Reilly Road
Frankfort, KY 40601
(502) 564-6716 x214

Bill Greenwich
Hazardous Waste Division
Office of Solid and Hazardous Waste
Louisiana Department of Environmental Quality
P.O. Box 44307
Baton Rouge, LA 70804
(504) 342-9079

Alan Prysunka Bureau of Oil and Hazardous Materials Control
Department of Environmental Protection
State House Station #17
Augusta, ME 04333
(207) 289-2651

Bernard Bigham
Maryland Waste Management Administrator
Department of Health and Mental Hygiene
201 West Preston Street, Room 212
Baltimore, MD 21201
(301) 255-5647

Ronald Nelson
Hazardous and Solid Waste Management Administration
Maryland Department of the Environment
201 W. Preston Street, Room 212
Baltimore, MD 21201
(301) 225-5647

William F. Cass
Division of Solid and Hazardous Waste
Massachusetts Department of Environmental Quality Engineering
One Winter Street, 5th Floor
Boston, MA 02108
(617) 292-5589

Gary Guenther
Waste Management Division
Environmental Protection Bureau
Department of Natural Resources
Box 30038
Lansing, MI 48909
(517) 373-2730

Allan Howard
Permits Unit
Technical Services Section
Waste Management Division
Department of Natural Resources
Box 30038
Lansing, MI 48909
(517) 373-2730

Richard Scanda
Solid and Hazardous Waste Division
Minnesota Pollution Control Agency
520 Lafayette Road, North
St. Paul, MN 55155
(612) 296-7282

Sam Mabry
Division of Solid and Waste Management
Bureau of Pollution Control Department of Natural Resources
P.O. Box 10385
Jackson, MS 39209
(601) 961-5062

Nick Di Pasquale
Waste Management Program
Department of Natural Resources
Jefferson Building
205 Jefferson Street
P.O. Box 176
Jefferson City, MO 65102
(314) 751-3176

Duane L. Robertson
Solid and Hazardous Waste Bureau
Department of Health and Environmental Sciences
Cogswell Building
Room B-201
Helena, MT 59620
(406) 444-2821

Mike Steffensmeier
Hazardous Waste Management Section
Department of Environmental Control
State House Station
P.O. Box 94877
Lincoln, NE 68509
(402) 471-2186

Verne Rosse
Waste Management Program
Division of Environmental Protection
Department of Conservation and Natural Resoures
Capitol Complex
201 South Fall Street
Carson City, NE 89710
(702) 885-4670

John A. Minichiello
Division of Public Health Services
Office of Waste Management
Department of Health and Welfare
Health and Welfare Building
6 Hazen Drive
Concord, NH 03301
(603) 271-4662

Dr. John Trela
Division of Waste Management
Department of Environmental Protection
32 East Hanover Street CN-027
Trenton, NJ 08625
(609) 292-1250

Richard Mitzenfelt
Groundwater and Hazardous Waste Bureau
Environmental Improvement Division
New Mexico Health and Environment Department
P.O. Box 968
Santa Fe, NM 87504-0968
(505) 827-2924

N. G. Kaul
Division of Hazardous Substance Regulation
Department of Environmental Conservation
50 Wolfe Road, Room 209
Albany, NY 12233
(518) 457-6603

William L. Meyer
Solid and Hazardous Waste Management Branch
Division of Health Services
Department of Human Resources
P.O. Box 2091
Raleigh, NC 27602
(919) 733-2178

Martin Schock
Division of Hazardous Waste Management and Special Studies
Department of Health
1200 Missouri Avenue, Room 302
Bismarck, ND 58502-5520
(701) 224-2366

Charles M. Taylor
Division of Solid and Hazardous Waste Management
Ohio Environmental Protection Agency
361 East Broad Street
Columbus, OH 43215
(614) 466-7220

Robert Rabatine
Waste Management Service
Oklahoma State Department of Health
P.O. Box 53551
1000 Northeast 10th Street
Oklahoma City, OK 73152
(405) 271-5338

Mike Downs
Hazardous and Solid Waste Division
Department of Environmental Quality
811 Southwest 6th Avenue
Portland, OR 97204
(503) 229-5356

Donald Lazarchik Bureau of Solid Waste Management
Pennsylvania Department of Environmental Resources
P.O. Box 2063
Harrisburg, PA 17120
(717) 787-9870

Santos Rohena
Environmental Quality Board
Santurce, PR 00910-1488
(809) 725-0439

Tom Getz
Solid Waste Management Program
Department of Environmental Management
204 Cannon Building
75 Davis Street
Providence, RI 02908
(401) 277-2797

Hartsill Truesdale
Bureau of Solid and Hazardous Waste Management
Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201
(803) 758-5681

Joel C. Smith
Office of Air Quality and Solid Waste
Department of Water and Natural Resources
Foss Building, Room 217
Pierre, SD 57501
(605) 773-3153

Tom Tiesler
Division of Solid Waste Management
Tennessee Department of Public Health
701 Broadway

Customs House, 4th Floor
Nashville, TN 37219-5403
(615) 741-3424

Hector Mendieta
Division of Solid Waste
Texas Department of Health
1100 West 49th Street T-610A
Austin, TX 78756-3199
(512) 458-7271

Bryan W. Dixon
Hazardous and Solid Waste Division
Texas Water Commission
P.O. Box 13087, Capitol Station
Austin, TX 78711-3087
(512) 463-7760

Brent Bradford
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Department of Health
P.O. Box 16700
288 North 1460 West Street
Salt Lake City, UT 84116-0700
(801) 533-4145

John Malter
Waste Management Division
Agency of Environmental Conservation
103 South Main Street
Waterbury, VT 05676
(802) 244-8702

Wladimir Gulevich
Division of Technical Ser.
Virginia Department of Waste Management
Monroe Building, 11th floor
101 North 14th Street
Richmond, VA 23219
(804) 225-2667

Chris Haines
Solid and Hazardous Waste Management Division
Department of Ecology
Mail Stop PV-11
Olympia, WA 98504
(206) 459-6316

Dr. B. Douglas Steel
Waste Management Division
Department of West Virginia Natural Resources
1260 Greenbrier Street
Charleston, WV 25311
(304) 348-5935

Paul Didier
Bureau of Solid Waste
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CONCERN, Inc. is a non-profit, tax-exempt organization, founded in 1970, that provides environmental information to individuals and groups and encourages them to act in their communities. The primary activity of this organization is the publication and distribution of reports which define key environmental issues and contain suggestions for individual and group action. Further support is offered through an active community outreach program. CONCERN's projects are supported by private grants and individual contributions.

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